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SHATTUCK LECTURE.

MASS. MED. SOCIETY.
1893.

TUBERCULOUS PLEURISY.

I. INCIDENCE OF TUBERCULOUS PLEURISY IN POST-MORTEM ROOM AND IN THE WARDS.
II. CLINICAL TYPES.
  1. Acute Tuberculous Pleurisy.
  2. Sub-acute and Chronic Forms.
  3. General Serous-membrane Tuberculosis.
III. GENERAL PATHOLOGY.
IV. DIAGNOSIS.
V. TREATMENT.

BY
WILLIAM OSLER, M.D.,
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TUBERCULOUS PLEURISY.

Mr. President and Fellows:—

Many members of your ancient and honorable body (Bowditch, Wyman, Ellis, Garland, Sears and others) have dealt with many problems in connection with pleurisy; and without making invidious comparisons it may be said that their contributions, more particularly those of the late Henry I. Bowditch, are the most important which have been made on the subject in this country. While modesty made me hesitate to select any question relating to pleurisy as the topic for the Shattuck Lecture of this Society, I felt that differences of opinion on many points—not the least on those concerning the frequency, varieties, and sequences of the form known as tuberculous—would justify the narration of an experience gleaned during the first four years of service in the medical wards of the Johns Hopkins Hospital.

I. Incidence of tuberculous pleurisy in the post-mortem room and in the wards.

(a) In the post-mortem room.—A trustworthy estimate of the incidence of tuberculous pleurisy can be had only by anatomical investigation. Uncertainty is inherent to clinical records of an affection such as pleurisy, the diverse etiological factors of which cannot be always discriminated at the bedside, even with the help of bacteriology.

Accordingly, with the kind assistance of Dr. Rupert Norton and with the consent of my colleague Prof. Welch, I have carefully analyzed the post-mortem records of the 101 successive cases from my wards in which pleurisy—fibrinous, sero-fibrinous, hæmorrhagic, or purulent—was found; and

the record is of interest as showing the incidence of tuberculous pleurisy in a medical service varying from 70 to 90 beds. Of the 101 cases, there were 32 in which the pleurisy was definitely tuberculous. I have estimated as such only those in which tubercles were present on the pleural layers, either as fresh miliary granulations, caseous masses, or diffuse fibro-tuberculous membranes. Of these cases there were eight with purulent exudate, all associated with pneumothorax, and two with hæmorrhagic fluid. Seven were cases of acute miliary tuberculosis with fibrinous and sero-fibrinous exudate; four were instances of acute miliary tuberculosis with a purely fibrinous effusion; and thirteen were cases of chronic sero-fibrinous exudate with more or less thickening of the pleural layers. In four instances the sero-fibrinous exudate was encapsulated.

There were thirteen cases of pulmonary tuberculosis in which pleurisy was present without our being able to say definitely that it was of a tuberculous nature. In ten of these cases the exudate was fibrinous, and three sero-fibrinous. It will thus be seen that the incidence of tuberculous pleurisy among these 101 cases was a little less than 32%. By far the most common forms of pleurisy are the sero-fibrinous and fibrinous secondary to acute disease of the lungs, or occurring as a terminal process in chronic affections of the heart, arteries, or kidneys.

(*b*) *In the wards.*—Passing now from the certain and definite data of the post-mortem room let us turn to the wards and inquire into the etiology of the cases of acute pleurisy which have been under observation. I have thought it better to review only those cases in which there has been a pleurisy with effusion coming on acutely or sub-acutely, and in which the effusion was sero-fibrinous, not simply fibrinous and not purulent. I have excluded the former from analysis because of the very great frequency, as the post-mortem reports show, of a simple fibrinous pleurisy in

so many varied conditions, often overlooked clinically, of which, of course, tuberculosis is one, indeed one of the most common. I have not included the purulent cases, partly because there is here much less dispute, as they have a more definite and well-recognized etiology, and partly from the fact that abscess of the pleura—empyæma—is regarded with us as a strictly surgical affection, and the cases are either admitted directly to the surgical wards or turned over at once. This may account for the somewhat remarkable absence of purulent pleurisies in the post-mortem records of cases from my wards, apart from the instances of pneumothorax. Still it must be noted that of 14 cases of empyæma operated upon, 12 recovered, exclusive of the cases of empyæma with pneumothorax. The cases in the following analysis, then, have been admitted to the wards with well marked signs of pleurisy with effusion. Of the 58 cases 45 were males; 13 females; 10 were in the colored race; 48 in the white.

In attempting to estimate from the clinical side the tuberculous character of a pleurisy the following points are to be considered:

First: mode of onset. In reality this is not a criterion of any moment, since it must be acknowledged that an acute tuberculosis of the pleura may come on abruptly with a stitch in the side, or even with a chill. A slow insidious onset is more common, but by no means characteristic.

It is so difficult to obtain from hospital patients accurate information as to the mode of onset, often indeed as to the duration of their illness before admission, that we cannot place very much reliance upon the facts so obtained; but the errors, I suppose, are equally common throughout the entire class. As a general rule, too, the patients do not seek relief until the symptoms have become aggravated. Thus it is interesting to note that in the 58 cases of serofibrinous pleurisy the duration of illness prior to admission

was given as one week and under in 8 cases; between one and two weeks, 16 cases; between two and three weeks, 7 cases; one month and over, 25 cases.

Of the symptoms for which they sought relief the following were the most striking: In two cases no history could be obtained. Of the remaining 56 cases the symptoms for which they sought relief were as a rule cough, dyspnœa and pain in the side; more rarely fever or chills and fever. Thus in 45 cases the patient complained of cough; in 44 of dyspnœa; in 41 of pain in the side; and in 14 there was a history of chills and fever. Cough and dyspnœa are by far the most frequent causes for which the patient seeks relief in hospital. In two only of the cases did the patient gave any definite account of an exposure to cold or of a wetting. As stated, the onset is no etiological criterion, and the claim at present is that a great majority of the cases of pleurisy *a frigore* are in reality tuberculous. In the history obtained from the patient, however, there may be very suggestive features; for instance, cough and loss of weight for some months previous, or hæmoptysis, or a previous attack of pleurisy. Thus, one patient, Case 1 of the series, had had a cough at intervals for three years, and when admitted the right side of the chest was full of greenish, sero-purulent fluid. After many tappings he improved very much, and, though the cough had persisted for so long, there was no sign of pulmonary disease, but subsequently bacilli were found in the expectoration. Another interesting case, No. 4, had hæmoptysis nine months before, and though he was an extremely robust, vigorous man, the insidious onset of the pleurisy led us to suspect tuberculosis. Bacilli were demonstrated in the exudate. The patient subsequently developed pulmonary tuberculosis. In two instances only the patients had pleurisy with effusion previously; in one five months before; in the other eight years before. Both did well, and both were discharged at the end of three weeks.

A second point, on which more stress has been laid than the facts justify, is the family history; but inheritance is now generally acknowledged to be of a susceptible soil, rarely of the germ itself. Local conditions are probably of most importance in influencing the susceptibility to an infectious agent so widely disfused as that of tuberculosis. Still it is interesting to note the presence or absence of tuberculosis in the ascendants or near relatives; thus in two of the fifty-eight cases the father died of tuberculosis; in four, the mother; in one, the father and mother; in six, a brother or sister; in one, a brother and sister; in four, an aunt or uncle; and in two the wife died of tuberculosis, in one the husband. In 37 of the cases positive questions as to tuberculosis in the family were answered in the negative, and in three it could not be obtained.

Third: the character and contents of the exudate. There is nothing specific in the physical characters of the effusion in tuberculous pleurisy, nothing from which on aspiration a definite opinion can be formed. The exudate may be sero-fibrinous, simply serous, hæmorrhagic, sero-purulent or purulent. Of these the hæmorrhagic and the thin sero-purulent may be called suggestive. Of the cases of acute pleurisy with effusion at the clinic seven were blood tinged. Of the cases from the wards in which pleurisy was found post-mortem, in four the effusion was hæmorrhagic; of these two were tuberculous and two were simple. The thin sero-purulent exudate, a little opalescent, often with a greenish tint, and which microscopically contains a granular, fatty matter and only a few leucocytes, is very suggestive of a tuberculous lesion. The cover-slip and culture tests, so much practised of late, yield variable results. In the first place it is conceded that the great majority of tuberculous sero-fibrinous effusions are sterile; organisms are neither found on cover slip preparations nor does anything grow in cultures. Our own experience is in accord with

this, except that in one case the tubercle bacilli were definitely determined in the exudate. This was after repeated tappings. A sterile effusion is regarded as a point in favor of the tuberculous nature. In the purulent tuberculous exudates the bacteriological results are also variable. In some of the acute cases, as in one which I shall describe shortly, the bacilli of Koch were abundant. In other instances only pus organisms or the diplococci are present, or there may be no micro-organisms. A more important and more satisfactory test is the inoculation of the exudate into the peritoneal cavity of guinea pigs, experiments which in the hands of some of the French observers have yielded positive results in the sero-fibrinous and purulent pleurisies of individuals apparently not tuberculous.

When Koch's tuberculin was in vogue it was hoped that it might at any rate give us a means of positive diagnosis. The report of the German hospitals shows that in the subjects positively tuberculous the great proportion of them present reaction, whereas in suspected individuals about 60 per cent., and in non-tuberculous subjects only about 25 per cent. Subsequently, in speaking of diagnosis I will narrate an instance in which the acute reaction to tuberculin led us into a serious error in diagnosis.

And lastly, the nature of the pleurisy may not be apparent for months or years, when the onset of a tuberculosis in other parts may indicate clearly the character of the whole process. You are all familiar with the striking statistics published of late years, none more interesting than those by Dr. Vincent Bowditch from his father's records. Such statistics from private practice are of infinitely more value, as a rule, than those from hospitals. The time has been altogether too limited at the Johns Hopkins Hospital to determine, even if we could, the subsequent history of the great proportion of the cases of sero-fibrinous pleurisy which have been under treatment. It is interesting to note, however,

in striking contrast to figures from some hospitals, that so far as our records go, only five of these patients have subsequently had tuberculosis. While our hospital figures are by no means in favor of the view that a large proportion of all sero-fibrinons pleurisies are of a tuberculous nature, I must confess that in private practice I have, year by year, been increasingly impressed by the frequency with which the subjects of pleurisy with effusion subsequently become tuberculous. Such cases as the following are not uncommon.

A few months ago I saw Dr. Martinet, a man aged 40, of fine physique and general good health, and excellent family history. In the summer of 1892 he developed, without obvious cause, pleurisy on the right side, and in this attack was seen on several occasions by Dr. W. S. Thayer. He was aspirated twice and made a very satisfactory recovery, and resumed his work. Three months subsequently he developed basilar meningitis, of which he died in three weeks. There was nothing in the condition of this patient or in the character of the pleurisy to justify the suggession of a tuberculous nature, but the onset of a meningitis which ran a long course like the tuberculous form, with strabismus, etc., rendered pretty clear the nature of the process. A very similar case I remember in the practice of my late colleague, Dr. Ross of Montreal. A young man was admitted with pleurisy on the left side and the history of having had a previous attack several months before. The effusion gradually diminished, but signs of local disease developed at the apex of the right lung. About three months after admission a purulent otitis media developed on the left side, followed shortly by meningeal symptoms, of which he died in the third week. The autopsy showed greatly thickened pleural membranes on the left side, many tubercles and local tuberculous disease at the right apex, with a tuberculous basilar meningitis.

I have seen recently a young man with an advanced pul-

monary tuberculosis, who consulted me first in Philadelphia in October, 1888, when he had the left pleura full to the clavicle with a serous exudate. There is no tuberculous history in his family. The disease set in insidiously with cough. He was tapped but once, and he rapidly gained health and strength. I did not see him again professionally until the autumn of 1892, when he had had attacks of severe prostration and shortness of breath, but very little fever. Since then, signs of local disease have developed and extended, and tubercle bacilli are present in the expectoration. Cases such as these could be paralleled from the note books of any physician in large practice. The cases from the wards which have developed pulmonary tuberculosis will be described later.

II. Clinical Types.

Tuberculous pleurisy may be part of a general miliary infection, but it is rare to find the pleuritic symptoms dominating, or even pronounced enough to attract attention. In reviewing any large number of cases, the character of the onset and the quick or slow course offer the most valuable features for classification, and separate two types, to which may be added a third, when the pleurisy forms part of a general serous membrane tuberculosis.

1. *Acute Tuberculous Pleurisy.*

It is difficult to say, in our present state of knowledge, the proportion of instances of acute sero-fibrinous pleurisy due to tuberculosis. The cases are rarely fatal; a large majority recover completely, in a few the condition becomes chronic, a variable number develop tuberculosis. More than this we cannot say, but clinical and anatomical study enable us to separate at least three groups of tuberculous cases in which the onset is acute.

(*a*) *Acute tuberculous pleurisy, with subsequent chronic course.*

There are cases of tuberculous pleurisy in which the disease sets in abruptly with pain in the side, fever, cough, and sometimes with a chill. There may be nothing whatever to suggest a tuberculous process; the subject may be of fine physique and of excellent family stock. Nor may there be anything in the course of the disease at first to excite suspicion. The effusion augments and the patient is tapped, perhaps repeatedly, and may get well with evidences of a greatly thickened pleura. Then the pleurisy may recur, and the case is labelled one of chronic pleurisy with thickening of the membranes, and finally the lung is infected, or tuberculosis of other parts becomes manifest. The following is a good illustrative case, of special value from the fact that the death occurred from an intercurrent affection, and we were able to study the condition of the pleura just about a year after the onset of the first illness.

Case 1.—Pleurisy, with acute onset; chronic course of nearly a year's duration; repeated tappings; acute pneumonia; death; autopsy.

John A., aged 45, was admitted to ward F of the Johns Hopkins Hospital, June 18th, 1892, complaining of shortness of breath and swelling of the feet and legs.

His mother and four or five of her sisters died of phthisis.

When young had (he was told) scrofula, and had an operation performed on both hips; the wounds discharged for two years. He was not then, nor has been since, at all lame. Ten years ago he had hydrocele on the right side, which was tapped. After childhood he grew into a remarkably strong, powerful man. Previous to January, 1892, he had been working in the Belt-line tunnel for nine months, and was in perfect health, weighing 235 pounds. He went

to Virginia, and while there, in January, his present illness began. While at work on a bridge he felt dizzy, had a severe pain in the left side, followed by cough, shortness of breath, much expectoration, which was not, however, blood tinged. He went to a hospital in Washington, and was told he had typho-pneumonia. He had high fever, and was evidently very ill. The feet were swollen, and he had at times heavy sweats. He was several months in hospital, and was convalescent only about a month before his discharge on June 2d. He does not give a very clear account of his symptoms while in the hospital at Washington, but he had cough and pain in the side, and he lay principally on his right side. He lost also a great deal of weight.

Condition on admission (by Dr. Thayer): Patient is a large framed, muscular, fairly well nourished man. He is propped up in bed, inclining chiefly towards the left side. Lips and mucous membranes of good color; respirations rapid, 32; pulse, 128, regular, tension rather high; radial vessels are somewhat sclerosed. Temperature on admission, 99°; weight, 175 pounds.

Inspection. Thorax; the left side looks larger and movements are much restricted. The cardiac impulse is seen to the right of the sternum.

Percussion gives clear resonance in the right front as far as the third rib, where, close to the sternum, in the fourth and fifth interspaces, it becomes flat. On the left side there is modified resonance below the clavicle, shading into absolute flatness at the second rib, in the erect posture; at the third rib when recumbent. The flatness extends over the whole of the left back. Tactile fremitus is absent over the flat region, and the breath sounds are distant and tubular. On the right side they are clear, loud and breezy. The heart sounds are heard best to the right of the sternum, and are clear, the second loud and sharply accentuated.

Examination of the abdomen was negative. The urine was clear, yellow, acid, faint trace of albumin, no casts. The patient was aspirated, and 1500 cc. of a clear, yellow serum withdrawn.

For the first month in hospital the patient's condition did not materially improve. He lost in weight from 175 pounds to 157; the temperature range was constantly between 98.5° and 100°, rarely going to 100.5°, and only once, on the second day after his admission, reaching 101.5°. The fluid gradually re-accumulated, and he was tapped on the 21st, with a withdrawal of 1280 cc. of fluid; on the 30th, when 1000 cc. were withdrawn; and on July 8th, when 1100 cc. were removed. Early in July he began to improve,—the appetite increased, and he gained in weight. On the third of August the following note was made: "The patient has been aspirated in all six times, the last time being on the 26th of July. On inspection, there is now very marked flattening of the left front. The expansion is greatest on the right side, on which percussion note is full and clear. On the left side there is flat tympany above the second rib, below absolute flatness. Over the flat areas there is a distant, tubular breathing, of almost the same intensity everywhere. The vocal fremitus is diminished. The breath sounds very nearly absent in the supraspinus fossa." He was aspirated the seventh time on August the 3rd, with removal of 800 cc., and the eighth time on August 16th, when 600 cc. were removed; the fluid of the last four tappings was blood-tinged. In the latter part of July and the first two weeks in August he improved rapidly and gained in weight, and on the 16th weighed 175 pounds.

The patient was discharged on August 18th, when the following note was made: "The left side of the chest seems somewhat sunken; right side expands fully and well, and looks large. At the left apex there is a flat tympany, which

shades into flatness at the fifth rib, just outside the nipple line. At the left back there is a marked dulness, becoming absolute about an inch below the angle of scapula. Above this point the vocal fremitus is felt, below it is absent. Respiration is heard, though feebly, everywhere except at the extreme base. The point of maximum cardiac impulse is not to be made out; the sounds are heard distinctly over the normal area; the second pulmonic sound is accentuated."

The diagnosis of pleurisy with effusion was made. No suspicion was entertained by Dr. Thayer, under whose care he came during my absence, that the process was tuberculous; indeed, there was no evidence whatever to indicate this, except that the last four tappings were slightly blood tinged.

November 30th, 1892. Patient was re-admitted to-day with dyspnœa, cough and fever. He states that he has remained well since discharged, August 18th, and has been working on the streets ever since. Three weeks ago he had slight shortness of breath after an unusual exertion, and ever since that has had slight cough with white, frothy expectoration. He worked every day until November 26th. Last evening he had a heavy chill, in which he shook for an hour. This was followed by fever, which persisted all night. This morning he spat up a little blood. His appetite has been good.

Condition on admission. Weight is 170 pounds. Temperature, 100.4 at 2 P. M., rising to 103° at 4 P. M. He had a profuse sweat in the afternoon, and the temperature fell to 98° at 6 o'clock. Pulse ranged from 80 to 120; respirations from 18 to 36.

December 1st. This morning patient is lying on his back, face somewhat flushed, lips and mucous membranes and finger tips somewhat cyanotic. Pulse 104, full, of fair tension. Respirations 32. There is marked flattening

in the left side in front; the right side of the chest expands fully. Resonance throughout the right front and axilla, good. There is marked dulness over the left chest, resonance in front having a slight tympanitic quality. There is dulness everywhere over the left chest behind, shading into flatness below the middle of the scapula. On the right side behind, the resonance appeared good, and the respirations were clear. On the left side behind, the breathing was distant, tubular, and in the infrascapular region scarcely audible, vocal fremitus distinct. Dr. Hewetson put in a needle in the left back and obtained clear fluid.

Heart; well marked epigastric impulse. The maximum impulse cannot be made out. The sounds are the best heard in the fourth interspace, 4 cm. from the sternum. The spleen is not palpable; liver not enlarged.

The sputum not very abundant, muco-purulent, blood tinged, contained a few distinct tubercle bacilli, and many encapsulated diplococci.

The urine, reddish brown, sp. gr. 1025, moderate amount of albumin, no tube casts.

December 3d. Within the past 24 hours the signs of consolidation have appeared in the right side, and have extended rapidly. This morning dulness begins at the third space in front, and is marked to the middle of the back behind. The breathing is of a modified, tubular character, and accompanied with fine crepitant rales. The temperature rose throughout December 1st, and between 6 A. M. and 4 P. M. of the 2d was continuously between 105° and 106°. For the past 24 hours the range has been between 103° and 104°. The pulse range has been from 106 to 120. The cough has been very distressing. The sputum is rusty, brown, tenacious, and contains tubercle bacilli. On the evening of to-day a moderate venesection was practised.

December 4th. The dulness has extended on the right

side behind, and there is now tubular breathing from the spine of the scapula to the base; pulse is good; the temperature fell last evening to 101°; this morning it is high again, 104°. The respirations are about 40. There is marked leucocytosis, 33,000 white corpuscles per cubic mm. During the day patient sank gradually, the pulse becoming feeble, in spite of the persistent administration of stimulants, ammonia, etc.; the temperature kept up, and he sank, and died at 2 A. M.

Autopsy (Dr. Flexner). Body of a large framed, well nourished man. Peritoneum smooth. Thorax; universal adhesions, which were readily stripped off on the right side. On the left side dense fibroid union of the layers of the pleura to a distance of about 8 cm. from the sternal margin. The heart much distended, with firm gelatinous clots; moderate hypertrophy of the left ventricle, distinct hypertrophy of the right, the walls of which were firm and considerably thicker than normal. No endocarditis.

In removing the left lung an encapsulated serous effusion was opened, occupying the layers of the pleura over the postero-lateral region of the left chest. The costal pleura was greatly thickened, ranging from 1 to 1.5 cm.; at the diaphragm, it was in places as much as 2 cm. in thickness. The visceral layer was also thickened, but not to the same degree, only from 3 to 5 mm. Both layers were smooth, greyish white in color, in places presenting areas of congestion and hæmorrhage. There was a good deal of greyish white gelatinous fibrin in places, closely adherent to the visceral pleura. There were no caseous masses, no spots of caseous infiltration on the surface of either layer. On section, the thickened pleura had the appearance and consistence of firm, new connective tissue, and at first sight it seemed as if the process were really a simple chronic pleurisy, more particularly as no miliary tubercles were noticed on the surface, and no caseous masses. On close examination,

however, of the cut sections, particularly in places, greyish translucent fibroid tubercles could be seen projecting above the cut surfaces. These were particularly marked in the thickened diaphragmatic layers. At one or two spots there were found small areas, from 3 to 5 mm. in extent, of greyish, yellow tuberculous infiltration. The left lung was very considerably compressed, but still it everywhere contained air, except at the extreme base. There were no miliary tubercles, no caseous masses. The right lung was large, voluminous, retained its shape, did not collapse, and was everywhere airless, except at the extreme apex, and the antero-lateral margin. The pleura was a little thickened, and covered with tags of old adhesions; no tubercles were seen. On section there was at the apex an area of caseation and softening the size of a walnut, surrounded with tubercles and smaller areas of caseation. This communicated directly with a good-sized bronchus. The lower part of the upper lobe, the greater part of the middle lobe, and all of the lower lobe, were in a condition of red hepatization. There were no miliary tubercles, no caseation. The bronchial and tracheal glands were greatly swollen, tumefied, and presented here and there small caseous masses. There was nothing of special note in the abdominal organs; no tubercles. In the right testicle there was a fibroid and cartilaginous, cyst-like structure containing cholesterin.

There was a marked tuberculous history in the patient's family, and the latter tappings were blood tinged, points upon which in a less robustly built man we would doubtless have laid greater stress. On his return with an acute pneumonia, tubercle bacilli, as well as pneumococci, were found in the sputum, and the former gave us, for the first time, a definite clue to the nature of the pleurisy, now chronic but in process of healing. It is interesting to note that the tubercle bacilli came from a very small focus of caseation and softening in communication with a bronchus.

(*b*) *The secondary and terminal acute tuberculous pleurisy.*

Here reference is not made to cases of general miliary tuberculosis in which the pleural membranes are involved with other parts. A miliary eruption is very often secondary to a local tuberculosis in the lung, and under these circumstances the exudate is usually fibrinous. It is interesting to note that in the 101 post-mortems from my wards, in the cases in which tubercles were found on the membranes only four had a simple fibrinous pleurisy. On the other hand, there were eleven instances of fibrinous pleurisy in persons dead of pulmonary tuberculosis in which there was no mention made of tubercles on the pleura. This accords with the well known experience that a pleurisy in the course of a pulmonary tuberculosis is not always due to the presence of tubercles. Acute miliary tuberculosis of the pleura, with a sero-fibrinous or hæmorrhagic exudate, was present in only seven of the autopsies. In every one of these cases the tuberculosis was secondary to some other affection, or occurred as the terminal event in some long standing illness. Whether or not in an instance, for example, of acute pleurisy with effusion, coming on in an apparently healthy individual, and which, for the sake of argument, we may presume to be tuberculous, the condition of the pleura is that of an acute miliary tuberculosis, I have no personal knowledge; but in my experience the condition has almost invariably been, as just mentioned, a secondary or terminal process in some already existing affection. The following are illustrative cases: In the first instance there was a chronic anæmia, induced by the hæmorrhoids, with old foci of caseous disease at the apices of the lungs. The death resulted from miliary tuberculosis, involving chiefly the pleural sacs.

Case II.—Hæmorrhoids; anæmia; chronic tuberculosis; caseous foci in the lungs; acute miliary tuberculosis of both pleural membranes.

R. S., male, white, aged 47, admitted October 21st, 1891, complaining of bleeding piles. He has always been a healthy man; never has had any illness, except the hæmorrhoids, which have troubled him at intervals for nine years. During the past few weeks they have been much worse, and he has lost blood with every stool, having had three or four evacuations every day. He says that he has lost as much as a pint of blood at one time. He has gradually become very pale. At present the hæmorrhoids are not bleeding.

Patient is a pale but well nourished man. On admission, the examination of the lungs was negative; the heart impulse was diffuse. The pulse was regular, small in volume. The spleen was not palpable, and there was no œdema. The urine contained a faint trace of albumin, but no tube casts. He was thought to have moderate grade of anæmia from bleeding piles.

About the middle of November the patient began to be delirious, but the temperature was not high, not more than 100° or 100½°. He had slight diarrhœa, from three to six semi-solid stools daily. He did not seem very ill, and was generally up and about and dressed, though he talked in a rambling, incoherent way.

About November 28th he began to have dyspnœa, which gradually increased. The temperature had not changed specially since his admission; had been ranging from 100° to 101.5°, and very rarely reached 102°. On December 3d the note was that he was propped up in bed; very pale; lips and mucous membranes blanched; respiration 32, labored and wheezing. Pulse 120; chest hyperresonant in front; dulness at both bases; below the angle of scapula an

absence of breath sounds. There was no expectoration. He continued to have three or four loose stools daily, and died on the 5th.

Autopsy. Large, well built, well nourished man, marked anæmia. Peritoneum is smooth. Over the mesentery, and the lower surface of the diaphragm, and in the pelvis, there are numerous elevated, translucent tubercles, some of them surrounded with areas of hyperæmia. The peritoneal surface of the intestine also presents numerous tubercles. The surface of the spleen and the contiguous diaphragm presents many tubercles.

Acute miliary tuberculosis of both pleural sacs, with about two litres of serous fluid in each. The membranes were covered with a thick, fresh fibrinous exudate, after the removal of which many miliary tubercles were seen. Both lungs were compresseed; no cavities; but at the apices there were old and partially softened caseous masses, with many miliary tubercles. In the lower lobes there were only few scattered tubercles. The spleen presented a few tubercles; no tubercles seen in the liver.

Intestines. One or two small ulcers, with irregular margins, in the ileum. The mesenteric glands hard and caseous.

Meninges were œdematous, but presented no tubercles.

In the following instance the patient died of an acute entero-colitis, with an acute miliary tuberculosis of the pleura as a terminal event.

Case III (abstract).—*Chronic entero-colitis; acute tuberculosis of the left pleura.*

Jos. A., aged 33, colored, admitted January 23, 1891, complaining of diarrhœa and colic. There was no history of tuberculosis in his family. He had gonorrhœal synovitis five years ago, and a chancre. For nearly a year he has been subject to diarrhœa. On admission, patient was

emaciated and anæmic; afebrile. The physical examination was negative. He had four or five stools daily, yellowish white in color, and containing undigested food; no amœbæ were found. He was very anæmic, had moderate fever, temperature range from 99° to 101°. The diarrhœa was uncontrollable, and he gradually sank, and died on February 28th. There was found an extensive enterocolitis, chiefly of the large bowel, with irregular ulceration. Almost the entire costal pleura on the left side was the seat of an extensive eruption of miliary tubercles, quite fresh, with hæmorrhagic zones about them, and much fibrinous exudate. These fresh adhesions extended along the diaphragmatic surface. The bronchial glands were caseous. There were no lesions in the lungs, except at the edge of the lower lobe, adherent to the diaphragm, there was a firm caseous mass, with some induration about it and colonies of miliary tubercles.

Post-mortem, we certainly see acute miliary tuberculosis of the pleura most frequently in the bodies of persons who have been under treatment for some chronic malady, affections of the heart and arteries, chronic Bright's disease, or scleroses of various sorts. Usually there will be found in these cases old foci of tuberculous disease, a caseous nodule at the apex, or in the bronchial glands, or in the mesenteric glands. Of late attention has been called repeatedly to the association of tuberculosis of the serous membranes, most commonly of the peritoneum, with cirrhosis of the liver; but a number of instances of terminal tuberculosis of the pleura have also come under my care in this disease, and it may exist without having caused symptoms enough to attract attention. In one of my wards at Philadelphia Hospital an elderly man, with cirrhosis of the liver and moderate ascites, and dulness at the right base, died suddenly of hæmorrhage from the stomach. The effusion on the right side, which we thought to be hydrothorax, as

it had come on without any special aggravation of the symptoms, proved to be acute miliary tuberculosis, with effusion. More frequently the symptoms are pronounced, as in the following case:

Case IV.—Fatty and cirrhotic liver; hæmorrhage from the bowels; bilateral acute tuberculous pleurisy.

Mrs. L., aged 27, admitted with hæmorrhage from the bowels and tenderness over the region of the liver, which organ was slightly enlarged. There was no jaundice. She was a hard drinker, and had been in failing health for some months. Signs of pleurisy were discovered on both sides, and she had a severe cough. She sank rapidly, and died within a week or ten days after her admission.

Autopsy.—Left lung covered with a thin fibrinous exudation, thickest at base and near the edges. In places the membrane is studded with minute granular tubercles, which are best seen where the exudation is less abundant. The organ is crepitant throughout, a caseous spot is seen at apex, and a narrow fibroid area in the lower lobe. No disseminated tubercles throughout the substance. The right pleura presents a similar exudation, less abundant than on the left side. The costal pleura is thickly lined with false membrane, is congested, and presents small grey bodies scattered through the membrane. At the apex of the lung is a small caseous mass, with a cavity the size of an almond, in direct communication with a bronchus. In the neighhorhood of this are several small groups of tubercles. The lower lobe also presents a couple of small caseous bodies, but no scattered tubercles. Liver weighs 2,200 grammes, is large and pale. Lobules distinct, bile-stained in centre. Organ is both fatty and cirrhotic. Other organs normal.

Such instances as the following are not rare in old hos-

pital patients with cardio-vascular and renal changes. More than once I have mistaken a terminal tuberculosis of the pleura for hydrothorax.

Case V.—General arterio-sclerosis; primary tuberculosis of right pleura.

Joseph A., aged 70, colored, laborer, admitted July 26th, 1892, complaining of shortness of breath and swelling of the feet. No family history to be obtained. His wife states that he has been a perfectly healthy man all his life. She never heard him say that he had any illness. With the exception, some years ago, of a gathering under the left arm, he has been perfectly well. He denies the use of alcohol to excess.

His present illness began suddenly four weeks ago with a shaking chill, which lasted about half an hour, and was followed by pain in the stomach and shortness of breath. He has had no return of the chills, but has complained of abdominal pain. Two weeks ago the legs began to swell, and he thinks the abdomen was also slightly swollen. For about the same length of time he has been a little irrational. There has been slight cough, and he has had to sit up in bed to sleep.

Present condition.—In bed, lying on the left side. He is somewhat emaciated; respiration rapid, 48; pulse 136, easily compressible, radials calcified; temperature 101°, rose in the night to 102.5. He is not rational, and constantly mutters to himself.

Thorax.—Resonance throughout the right front is good, but rather tympanitic; in the upper left front it is full, and somewhat tympanitic in character. Respirations everywhere accompanied by an expiratory groan, and in front they are harsh, and there are occasional râles, which, on the left side, are medium-sized. Behind the resonance is impaired at the right base, clear on the left side; on both

sides respiration is harsh, and accompanied with fine, moist râles. Heart impulse is in fourth, fifth and sixth spaces; maximum in sixth, 3 cm. outside the nipple line. Relative dulness at third rib. Sounds are feeble and heard with difficulty.

Patient was taken home August 11th; the dilatation of the heart had subsided under the use of digitalis. He had slight diarrhœa, which was checked with alum enemata. The signs of engorgement in the lungs disappeared, and he had no pulmonary symptoms. The case was regarded as one of hydrothorax, secondary to the dilated heart in chronic arterio-sclerosis. Death occurred about two weeks after he left the hospital.

Autopsy (Dr. Flexner and Dr. F. R. Smith)—(*Abstract*).—The patient was found to have general arterio-sclerosis, with hypertrophy of the heart. The pericardium was smooth. The right pleura was thickened and the pleural layers uniformly adherent. The costal membrane measured about 4 mm. in thickness, and was covered with tubercles, somewhat larger in size than miliary granules, and, as a rule, caseous. The underlying thickened infiltrated tissue was yellowish, and consisted of a diffusely caseous mass. The outermost layer was more fibrous. The pleura covering the diaphragm was greatly thickened and infiltrated. The lung was somewhat compressed, deep salmon color, and contained no tubercles. The left pleura was not especially thickened; no adhesions. There were small miliary nodules, however, on the visceral layer. The apex of the lung was somewhat retracted, and on the anterior edge of the upper lobe there was an area of caseous pneumonia, with a small central cavity. There were, however, a few scattered tubercles throughout the posterior part of the lung.

(*c*) *Acute tuberculous suppurative pleurisy.*

A considerable number of the purulent pleurisies, designated as latent and chronic, depend upon tuberculosis, but the fact is not so widely recognized that acute ulcerative and suppurative disease, of a most severe type, may occur and run a very rapid course. In the following remarkable case the disease attacked a young, healthy woman, of good family history, and set in abruptly with a chill and severe pain in the side. On admission there was dulness in the right side, feeble breathing, but there were features about the physical examination which made us a little uncertain as to the nature of the case, and nothing was obtained on several aspirations. Within a few days, however, it seemed so clear that suppuration must be going on that Dr. Halsted was requested to operate. Instead of finding any large collection of pus, there were small pockets varying in size from a marble to a chestnut and though portions of ribs were resected in three different places no large collection was found. The symptoms persisted, and death took place about five weeks after the onset of the illness. Remarkable ulcerations were present throughout the right pleura, with pockets of pus between the adherent layers, no large accumulation, and an extensive acute miliary tuberculosis of the lungs. The tubercle bacilli were present in large numbers in the pus. Full details of the case are as follows:

Case VI.—Suppurative tuberculous pleurisy; numerous pockets of pus; operation without benefit; miliary tuberculosis of lung.

Lizzie W., aged 21, German by birth, was admitted to ward *G*, April 7th, 1893, complaining of chills, fever, and pain in the right side.

Father and mother living and well; one sister living; no history of hereditary disease in the family.

She has always been a perfectly healthy girl. Has been

in service; has only been in this country a short time. She had erysipelas of the head and face some months ago, and has not been quite so well since. She was seen by Dr. Salzer, who found signs, he thought, of effusion at the right base, with high fever, and he ordered her removal to the hospital.

Present trouble began, she says, fourteen days ago with pain in the right side and fever. She had a chill about six o'clock, and a had a sweat at night. The pain was of a dull character, and much aggravated on drawing a deep breath. There was no cough. The fever, pain in the side, and sweating have been the chief symptoms throughout her illness. She has been unable to work since its onset. The appetite is poor, and she has lost considerably in weight.

April 8th. Present condition. — Small framed, well nourished young woman. Lips and mucous membranes of a good color; tongue slightly coated. Temperature on admission was 101°; this morning, at 10 A. M., it was 102.5°; pulse 88; respirations 28. Chest is well formed; good costal angle; both sides expand well, the right much less than the left.

On percussion there is flatness on the right side from the fourth interspace in parasternal line; from the fifth rib in mammillary line; from the sixth in anterior axillary line. At the back there is flatness below the angle of the scapula. The breath sounds are clear in the infra-clavicular region, and as low as the nipple. Below this, behind and in front they are feeble, though clear. Behind, over the flat areas, respiration is feeble and distant. The vocal fremitus is absent over the flat areas. There seems to be a slight movable dulness at the level of the nipple in front. The cardiac impulse is in the fourth interspace in normal position. The sounds are clear, and of normal relative intensity. The abdomen is negative. The liver dulness reaches to

the costal margin; the border was not palpable, and there is no pain on deep pressure. The urine is whitish yellow, acid, 1020; no albumin. It was thought probable that the case was one of empyema, and on the 10th an exploratory needle was inserted in the fifth space in the anterior axillary line, but nothing was obtained. The temperature range during the next week was very irregular, reaching sometimes to 104° or 105°. She had chilly feelings and heavy sweats at night.

On the 11th the following note was made: Pulse 130, regular, soft; she is propped up in bed; respirations are quiet. Patient lies somewhat on the right side. The left side of the chest moves freely. On percussion and palpation there is great tenderness over the sternum, particularly at the third right interspace and at the sternal end of the fourth costal cartilage. The line of dulness begins at the fourth space at the sternum, and passes through the nipple. The flatness extends across the sternum. Lower border of the liver is not palpable, but the flatness extends in the nipple line to costal margin. The respiration above the line of flatness is clear, below feeble, distant, and difficult to hear. Vocal fremitus, while practically absent in front, is to be felt in the axilla. In the back the line of flatness has not materially changed from that noted on entrance. On auscultation, as one approaches this line, there are fine, moist râles on inspiration, which are increased by coughing. The apex beat of the heart is not dislocated outward.

An exploring needle was again introduced; this time at the eighth space below the angle of the scapula, but with a negative result.

On the 12th the temperature was 105°; the pulse this morning was quieter, only 80 to the minute; tongue was not dry. There was to-day extreme sensitiveness along the right margin of the sternum, particularly in the third and

fourth interspaces. The blood count gave over 5,000,000 red to the cubic mm., and 18,000 white corpuscles.

It seemed evident that there was suppuration going on in the chest, and it was thought most likely to be an empyema, possibly diaphragmatic. The possibility also of a subphrenic abscess was considered, though this did not seem to be very likely, as the liver was not depressed. The points which made the case somewhat dubious were the extent of dulness and signs of effusion without marked dislocation of the heart apex, and without anything like a typical line of dulness and not of movable character. The absence of fluid also, on aspiration with a good-sized exploring needle, suggested that there was something unusual.

The case was transferred to the surgical department, and on the 13th Dr. Halsted operated.

Under ether an attempt was made to find the abscess cavity by means of an exploring needle, which was thrust into the right side of the chest in several places, where dulness was marked. Then a portion of the fourth rib over the painful spot was excised, and only a small pocket of pus found; portions of the sixth and of the eighth ribs were also removed, but only small areas of suppuration within the pleura were seen. The wounds were stuffed with gauze, discharged for a time freely. Tubercle bacilli were extraordinarily abundant in the pus. The patient died early on the morning of May 8th.

Autopsy (Dr. Barker).—Body somewhat emaciated. Scars of the incisions mentioned above, and two of them had slight sinuses. On making the preliminary median incision pus oozed from beneath the skin over the sternum. On stripping back the skin, fistulous sinuses were seen close to the edge of the sternum in the second, and third, and fourth interspaces.

Thorax large; costal angle wide. Right pleural cavity has been largely obliterated, the visceral being intimately

adherent to the costal pleura; both layers greyish white in color, thickened and infiltrated. Over the lower lobe it is in places fully 2 cm. in thickness, and it is adherent to the diaphragm. Tubercles have grown through the diaphragm and appear on the peritoneum. On this diaphragmatic surface of the pleura there are a number of abscesses filled with greenish pus and cheesy material; the walls are lined with necrotic tissue. In front, between the pleura and the diaphragm, corresponding to about the seventh costal cartilage, there is a large recent abscess the size of a hen's egg, which has infiltrated the diaphragm and made an ovoid indentation on the surface of the liver. Several of these intra-pleural abscesses exist along the spine, and have eroded slightly the bodies of the vertebræ. Here and there over the surface of the middle and upper lobes, between the layers of the thickened pleura, are recent abscesses, varying in size from a marble to a walnut. The whole lung is thickly studded with a minute miliary and sub-miliary tubercles, grey and translucent.

On the left side there are no adhesions, and beneath the pleura there can be seen a few minute miliary tubercles, which are thickly set throughout the lung substance. The pleura is not at all thickened. The bronchial glands are somewhat enlarged, deeply pigmented, and thickly studded with tubercles. The pericardium presents a few small miliary tubercles; no exudation. There is a small miliary tubercle on one leaflet of the mitral valve. The spleen is enlarged and soft, weighs 445 grams, and presents many miliary and sub-miliary tubercles. The same are present throughout both kidneys. In the ileum, Peyer's patches are reddened, and in some there are minute greyish white and yellowish white miliary nodules. The mucous membrane of the ileum, just above the valve, is completely studded with tubercles. Some are softened and breaking down, and there are slight superficial losses of substance.

The mesenteric glands are somewhat enlarged and hyperæmic. There are also pale yellow areas. The glands along the aorta are enlarged, and many of them caseous. The glands along thoracic aorta are also enlarged and caseous. The cover-slips from the pus in the pleura show large numbers of tubercle bacilli. Agar Esmarch's tubes, made from the pleural pus, spleen, liver and kidneys, remain sterile.

2. *Sub-acute and chronic Tuberculous Pleurisies.*

There are two groups of cases, with effusion, and the chronic adhesive form, the former being by far the most numerous.

(*a*) *With sero-fibrinous effusion.*

The process may be primary, or, at any rate, most extensive in the pleura, or secondary, to manifest tuberculosis of the lungs.

The primary constitute an extremely important division of the tuberculous pleurisies, and here may be reckoned a not inconsiderable number of all the cases of the insidious form. The true character of the disease is frequently overlooked, and indeed for a long time there may be nothing positive on which to base a diagnosis. Though we speak of the disease as primary in the pleura, in almost every instance there are tuberculous foci in the lungs or in the bronchial glands, or the process has extended from the peritoneum. Frequently the cases are admitted to hospital with acute manifestations, but with advanced pleural lesions, evidently of long standing, ante-dating the pulmonary tuberculosis. The following are illustrative cases:

Case VII.—Bilateral tuberculous pleurisy; acute tuberculosis.

Henry W., aged 43, admitted July 29th, 1891. Rather

more than a year ago, patient was in hospital for jaundice, and was discharged well. He returns complaining of cough, and shortness of breath. He states that his present trouble began about four weeks ago; he woke-up in the night with shortness of breath; has had chilly feelings, though no rigors, and had felt very weak. He has had some cough, very little expectoration, no pain; no œdema of feet. He does not think that he has lost any in weight. Temperature on admission was 102°; the following morning 103°; pulse 128; respirations 36. The urine is dark yellow in color, clear, no albumin; Ehrlich's reaction not present.

The chest is broad and deep, expansion fair, a little more on the left than on the right. Percussion is clear on the right side at the apex, and to the fourth rib; below which there was impaired resonance. On the left side a clear note to lower border of second rib; dulness from the second to the fourth, and from the fourth rib in axilla there is flatness. Defective resonance over the central portion of the lung behind, and flatness at the base. In the left lung there are numerous rales at the apex, with pectoriloquy, and behind distant tubular breathing. Breath sounds are almost absent at the left base. On the right side there is flatness at the base, with distant tubular breathing. Effusion was suspected at both bases, and he was aspirated in the eighth right interspace behind, and a small amount of hæmorrhagic effusion found. On the following day he was aspirated at the eighth left interspace behind, and a few cc. of fluid (hæmorrhagic) removed. The sputa contained tubercle bacilli. The temperature was high, from 103° to 104½°. He became delirious, had rapid breathing, blueness of the finger tips developed, and the pulse became much enfeebled, 130, and he died on the morning of February 4th.

Autopsy (Dr. Councilman).—Large, well-developed, well-nourished man; circumference of the thorax in nipple line 93 cm.

Left pleural cavity partially obliterated by old adhesions, especially at the apex and posteriorly. The remainder of the cavity filled with about 300 cc. of turbid, yellow serum with flakes of fibrin. Both layers of the pleura much thickened by a new grey vascular tissue, and covered with a gelatinous fibrin. There are many opaque white nodules beneath the membranes, and the thickening is marked. The layers can be peeled off as a continuous membrane, and beneath them can be seen opaque yellow and grey miliary tubercles. The right pleural cavity presented old adhesions only at the base, and it contained 350 cc. of serofibrinous fluid, the surfaces covered with fresh grey fibrin; the pleura and the membranes slightly thickened.

The pericardium was smooth; heart presented nothing abnormal.

Lungs.—At the apex of the left lung there is an irregular cavity measuring 3 by 5 cm., the tissue about it in a condition of gelatinous and tuberculous pneumonia. There are clusters of tubercles and miliary granulations scattered throughout the rest of the lung. The right lung presents a few scattered miliary tubercles without any very large areas of consolidation.

A few fine miliary tubercles were found in the kidneys; mesenteric glands presented a few small tubercles.

The condition of the pleura here ante-dated evidently the more acute onset of his final illness, and he was probably the subject of a latent tuberculous pleurisy, followed by a general infection.

Case VIII.—Chronic tuberculous pleurisy with effusion.

E. S., male, aged 31, colored, admitted January 12th, 1891, complaining of cough, pain in the right side, and dyspnœa. He has had cough at intervals for a year; no hæmorrhage. About Christmas of last year he got very

much worse, and since then has had high fever, night sweats, dyspnœa, and abundant expectoration. His family and personal history are good.

He is well nourished; face, lips, mucous membranes and finger tips are cyanosed. Temperature 102°; pulse 128; respirations 54. On the left side there was dulness from the second rib, and the heart was pushed over to the right side. He was aspirated and 792 cc. (27 oz.) of fluid removed. After aspiration the chest was clear to the lower border of third rib, below that dulness shading into flatness at the base. The temperature range was high, 102° to 104°, and he had a good deal of cough. The patient was aspirated again on the 23d and one litre of fluid removed. The sputa was examined repeatedly, with negative results, until the 1st of February, when bacilli were found in moderate numbers. The fluid did not re-accumulate to any extent. Very marked defective expansion on the left side. Breath sounds were clear on the right side; fremitus was present on the left side to the base, though the dulness was still very marked, and distant tubular breathing with fine râles. The note states that there was no diffuse, general bronchitis, such as might occur with an eruption of miliary tubercles. Pulse became rapid; he had delirium; the temperature kept high until the 31st, and it fell to 98° on the 3d, when he died.

Autopsy (abstract).—Right pleura adherent over entire extent; firm. Left pleural cavity contains about 1200 cc. of slightly turbid serum. Left lung compressed, tough, leathery, dark red; adherent posteriorly along the spine; lower lobe presented several firm tubercles. The pulmonary and costal pleura layers were thickened and tuberculous. Right lung presented, in the upper lobe, numerous firm, grey tubercles and caseous areas. At the apex a small cavity about 2 cm. in diameter. The lower lobe was very œdematous. A few miliary tubercles scattered throughout

the lung. Small ulcer in the left vocal cord. No tubercles in the liver or spleen; one small tuberculous ulcer in the intestines.

More commonly the pleurisy sets in insidiously, and is the most prominent feature in the case. There may be no suggestions of tuberculosis, but in some instances the history of a previous attack, or of hæmoptysis, may arouse suspicions. After aspiration the fluid re-accumulates, and repeated tappings may be necessary. The patient regains a certain measure of health, with greatly thickened pleural membranes, and persistence of the dulness on the affected side. When these cases are carefully followed, a certain number of them develop unmistakable pulmonary tuberculosis, or they die of a general infection. The following illustrative cases are of interest, from the fact that they were under observation for longer periods than is usual in hospital practice.

Case IX.—Cough and hæmoptysis a year before; gradual onset of the effusion; repeated aspirations; tubercle bacilli found in the exudate; subsequent development of pulmonary tuberculosis.

Christian T., aged 39, German, admitted September 25th, 1889. Patient is a large, well built, muscular man, very well nourished, with thick panniculus adiposis. With the exception of measles as a child, chills and fever in Germany, and a chancre with mild secondaries in 1884, he has enjoyed excellent health. No history of pulmonary trouble in his family. His wife died of consumption four years ago. He was very well and strong until about a year ago, when he had cough with much expectoration, and on one occasion he spat up a mouthful of blood. In January, 1889, he lost in weight, and for the first time began to be short of breath. He had no pain, and was able to be at work, but on any

exertion he became breathless, and he states that this has been his chief symptom, and for it he now seeks relief. He does not think that he has had any fever; temperature on admission was 98°. The patient looks in excellent health; weight about 160 pounds; pulse is 72; tongue is clean. The chest is large, well formed. On quiet breathing there is no special difference noticed, but the right side looks fuller than the left. When he draws a deep breath the right expands very slightly. The apex beat of the heart is visible in the fifth interspace, but an inch and a half outside the nipple line. The intercostal spaces are not marked on either side. From behind, the right side of the chest looks fuller than the left. On palpation there is absence of fremitus on the right side, except just below the clavicle, and there is absolute dulness from the clavicle down, and anteriorly it extends to the left border of the sternum. Breath sounds are feeble and distant on the right side, except in the lower interscapular space, where they are tubular and distant. On the left side the breathing is breezy and loud. On the 28th, 30 ounces of clear fluid were removed. On the first of October the dulness was practically the same, and 30 ounces were again withdrawn. This time it was more turbid. On the 6th he was aspirated again; 25 ounces. Cover slips and cultures were negative. His general condition all this time was excellent. He was up and about the ward, and the temperature was normal. On the 11th he was again tapped, and 32 ounces of fluid withdrawn. He had a very slight cough with much muco-purulent expectoration, which was examined daily for seventeen successive days without discovering bacilli. Although the history of an attack a year ago, with cough and hæmoptysis, raised a suspicion that the process might be tuberculous, there was nothing whatever to guide us to that conclusion; and it was not until he had been under observation for nearly three weeks, and his convalescence was practically established, that tubercle bacilli were found.

On the 18th he was aspirated and 32 ounces were withdrawn, and the note became clear as low as the nipple. On 27th 19 ounces were removed. On November 7th the note reads: "The right lung is fairly resonant to the fourth rib, and in axilla to eighth, posteriorly to middle of scapula." The fluid again accumulated, and on the 16th 28 fluid ounces of a greenish yellow, slightly turbid fluid were removed, in which tubercle bacilli were found by two separate observers on the 16th and 17th. The measurements on the right side, 19 inches, on the left 18½ inches. On the 14th he was aspirated for the eighth time, and 32 ounces of fluid removed, of the same clear character. The note was resonant to the fifth rib and behind to the middle of the scapula. In these regions the breath sounds were loud and free from râles. Cultures from this fluid remained negative, and no bacilli were found. Patient gained in weight, lost the cough entirely, and was only short of breath when walking fast. Appetite good; sleeps well. He decided to go out, and was discharged December 19th. At the time of his discharge resonance was clear and a little high-pitched on the right side to the third rib in front; below this there was absolute flatness. Behind it is high-pitched to spine of scapula, and below the note is flat; left lung clear. Breath sounds are normal. This patient was under my observation on and off in the dispensary for many months, and at first seemed to do well. Subsequently he was lost sight of, but I heard that he had developed extensive tuberculous disease of the lungs.

Case X.—Cough for several years, but good health; gradually shortness of breath; right-sided pleural effusion; repeated aspiration; great improvement; discharge; subsequent detection of bacilli in sputum; development of pulmonary tuberculosis.

Henry H., stevedore, aged 36, admitted June 13th, 1889,

complaining of severe cough. A sister and one brother died of consumption; father of asthma. The patient has been an extremely healthy man, and looks vigorous and well nourished. He states, however, that he has had a cough for many years, certainly for as long as three years. He has been getting short of breath lately. Patient is not at all anæmic; chest is well formed; the right side looks full, and is almost motionless on deep inspiration; the apex beat is in the fifth interspace, two inches outside the nipple line. The left side measures 19 inches, the right 20 inches; expansion on the right side is scarcely a quarter of an inch; on the left over an inch. Percussion gives on the right side a dull note to the clavicle in front, behind to the top of the lung, and to the left a little beyond the mid-sternal line. The left side is resonant. Tactile fremitus is very much lessened, but on saying 99 it is not entirely absent on the right side. Breath sounds are distant, feeble, scarcely audible. Whispered voice over the dull region behind is not heard. Exploratory puncture shows a thin, greenish yellow, sero-purulent fluid. The following day he was aspirated and 2½ litres of fluid withdrawn; the accumulation was rapid, and on the 17th the condition was very much as before. He was aspirated again, and 32 ounces of fluid removed. This fluid was greenish yellow, with many fat molecules. The fluid re-accumulated rapidly, and he was aspirated again on the 19th with a withdrawal of 32 ounces, and on the 22d with a withdrawal of 29 ounces, and on the 26th with a withdrawal of 27 ounces. On the 29th it was noted that in front percussion is now clear to the level of the nipple; dulness from this point down. Posteriorly it is clear to the middle of the scapula. There are fine crackling râles in the axilla, distant breath sounds over the dull area. By the 8th of July he had improved so much that he was discharged. The heart impulse was in the fifth interspace, just below the nipple, and there were marked friction sounds

in the left mammary region and in the scapular region behind. The cover slips and cultures made by Dr. Abbott from the fluid were negative. When he entered the hospital the sputum was abundant, sero-purulent, and was examined repeatedly with negative results. Subsequently his cough lessened and expectoration was more scanty, thicker, and greyish yellow in color. At no time did the temperature rise above 100°, and it was usually between 98° and 99°.

He left the hospital with a diagnosis of pleurisy with effusion, and though there was a suspicion, based chiefly upon the fact that he had had a cough for so long, the diagnosis of tuberculosis could not be positively made, and he looked such a vigorous, healthy man that it did not seem likely. He attended in the dispensary, where I saw him repeatedly. On the 20th of July it was noted that though the apex beat was just below the nipple in normal position, there was everywhere defective resonance over the right side, not absolute flatness, and everywhere from the second rib down there could be heard a loud, leathery, creaking friction. He remained in very good condition, though the cough still persisted. He had no fever. On September 10th tubercle bacilli were found in his expectoration. The leathery, creaking friction persisted, and the defective resonance on the left side. He had lost somewhat in weight, and the cough had become aggravated. On September 4th, 1890, I made the following note: There is marked depression of the right shoulder; shrinkage of the right chest. Heart is a little drawn over; impulse in left parasternal line. The resonance is defective above, and shades to dulness below the level of the fourth rib. The tactile fremitus is felt to the base. At the right apex the breath sounds are somewhat feeble; there are numerous râles on coughing, and on drawing a deep breath the sounds are amphoric. Marked cavernous breathing at the apex behind.

The breath sounds are feeble over the whole of the right base. Patient was under observation throughout 1891. He constantly had cough, and lost a good deal in weight. On the 22d of June the note was: He still looks well; the feet swell at intervals; temperature normal; the right chest more contracted and the spine is curved. Even on deep inspiration there is very little mobility. Marked cavernous signs at the right apex. There is no note of the patient after this date.

Case XI.—Pleurisy five months before; acute onset of second attack; effusion on left side; gradual recovery; detection of tubercle bacilli in sputum, three and a half years after signs of disease at both apices.

The following case illustrates the importance in diagonsis of a systematic examination of the sputum:

Jos. A., aged 29, German, admitted July 1st, 1889, complaining of pain in the chest, cough and shortness of breath. A brother died of consumption in 1885. Parents dead, not of tuberculosis. The patient was well as a boy and enjoyed excellent health. Five months ago he had an attack similar to the present one; was ill in bed for two weeks. He got quite well, but it left him with a little cough. Present illness began six days ago, June 24th, with fever, chilly feelings, and slight cough. He worked until the 29th, and only went to bed yesterday; temperature on admission 102°; respiration 40; pulse 96. Well built, healthy looking man. Chest well formed, movements equal in upper zone, less on the left side below; most evident on deep inspiration, when the difference in expansion is also very noticeable. Tactile fremitus is much lessened at the left base. There is a hyperresonant note at the left apex, extending into mammary region and axilla, which shades into dulness below the seventh rib, a dulness which is

extremely movable and ascends when he sits up. Behind it reaches to the middle of the scapula. Distant, tubular breathing over the dull region. No friction. Sounds on the right side clear.

Apex beat of the heart not palpable; sounds clear. Dulness in the sitting posture at the level of the fourth rib; movable dulness very marked. The temperature 101°; the cough is better; sputum is muco-purulent, and does not contain bacilli. On the 8th the temperature had fallen to 98°. The effusion had not increased, and the movable dulness is now more difficult to obtain. Though there were a few râles in the left infra-clavicular space, there did not appear to be signs of any cavity. The pleural effusion gradually diminished, and we were inclined to regard the case as one of simple pleurisy. He still had cough, with streaked mucoid and yellowish expectoration, and in it, on the 18th, well-characterized tubercle bacilli were found. He improved very much, and on the 22d decided to go out. On the left side the resonance was clear to the sixth rib. There were subcrepitant râles over the third rib, and in the lower axilla slight friction sounds. There was dulness in the infra-scapular region, diminished tactile fremitus, and feeble breath sounds.

This man was lost sight of until February, 1893, of the present year, when he applied at the dispensary, complaining of cough and pains in the chest, and diarrhœa. He has kept pretty well since his attack in 1889, and has been at work. He is now fairly well nourished. He has very slight expectoration, and none could be obtained for examination. There is rather a high-pitched note over both apices and there are moist râles, greatly increased by coughing.

The effusion in these cases is sero-fibrinous, often has a

greenish tint, is sometimes a little turbid. The fluid is not hæmorrhagic so frequently as in the more acute cases. Bacteriologically it is commonly sterile, though in the case of Christian T. tubercle bacilli were found in the exudate itself.

Sero-fibrinous pleurisy, occurring in the course of pulmonary tuberculosis, does not interest us very much. The cases are by no means uncommon, and the diagnosis is readily made. It may be a very early complication and over-shadow in great part the lung disease. The insidious onset and the absence of pain in the side not infrequently lead to errors in diagnosis, and the increasing shortness of breath may be attributed to advance in the original disease, or even to a general tuberculosis. It has seemed to me that the early implication of the pleura, even with recurring exudation, gives a stamp of chronicity to the case. Sometimes it is difficult, even post-mortem, to determine which has been the primary disorder, as in the following case; though, from the great thickening, it is probable that the affection of the pleura preceded the disease at the apices.

Case XII.—Extensive pulmonary tuberculosis; chronic tuberculosis of right pleura.

Alice S., aged 20, colored, admitted October 12th, complaining of cough, shortness of breath, and weakness. She knows nothing of her family history, further than that her mother died of asthma.

Patient was healthy as a young girl. About four months ago she had a child; was in bed for eighteen days. Her present illness began, she thinks, about a month ago. She has had a cough, but has been able to work until three weeks ago. Says she has only been spitting "thick stuff" for about two weeks, and during this time she had had a great deal of shortness of breath.

Present condition.—She is emaciated; much more so than is consistent with a history of an illness of such short duration. The thorax is long and narrow. The clavicular depressions are marked. The expansion is more marked on the left than on the right side. Briefly, the physical examination gave—at the left apex, signs of an extensive cavity, with cracked pot sounds, and amphoric breathing; at the right apex there were indications of a smaller cavity. Behind, there was marked dulness in the supra-spinous fossæ, and impaired resonance over the whole of the right side below the spine of the scapula, with feeble breathing, and râles only on full inspiration. The abdomen was swollen and tympanitic; no signs of effusion.

The patient had an irregular, hectic fever; her pulse was very rapid; she failed progressively, and died on the 18th.

Post mortem (by Dr. Flexner. *Abstract*).—The pericardium is adherent to the right pleura, but is itself smooth on both of its layers. The right lung is universally adherent; the left is adherent at apex and in places behind. The left lung presented a large, irregular cavity at the apex, numerous groups of miliary tubercles and caseous masses, with small cavities in the middle and lower lobes. Where adherent, the pleura is not specially thickened.

On the right side the pleura is everywhere adherent; the entire lung is much reduced in volume, and measures only 12.5 cm. in length. The top of the upper lobe is occupied by an irregular cavity lined with slate colored granulation tissue. The pleura of this lung is enormously thickened, more particularly the costal layer, which measures 9 mm. on the side, and about 11 mm. on the diaphragm; and in other places it is at least 2.5 cm. The thickened membrane is uniformly yellowish in color, and shows cheesy masses. Where the visceral and costal layers are not adherent there is fibrinous exudate on both surfaces, which, when scraped off, shows tubercles on the membranes.

The bronchial glands are coal black in color, and caseous. There is marked intestinal tuberculosis, and the retro-peritoneal glands are enlarged and caseous.

(*b*) *With purulent exudate.*

I have already spoken of the acute purulent form of tuberculous pleurisy. Such cases, however, are rare. The purulent tuberculous pleurisies are much more commonly sub-acute in onset, chronic and latent in their course. The effusion is usually sero-purulent, thin, and contains a large amount of fatty matter. It is somewhat interesting to note that among the 32 cases in which tuberculous pleurisy of one form or another was present in the cases examined post-mortem from my wards, there was not an instance of purulent effusion, except in pyopneumothorax secondary to tuberculosis of the lung. In the non-tuberculous cases there were but two with purulent exudate, one consecutive to an acute croupous pneumonia, in a case, oddly enough, of tuberculous peritonitis; the other in an old man with arterio-sclerosis, who had a purulent effusion on the left side and a sero-fibrinous pleurisy on the right. In both instances pneumococci were found in the exudate.

Our clinical reports embrace ten cases of pyopneumothorax, of which eight were tuberculous, and which, of course, do not interest us specially in this connection. Of the 16 cases of empyæma, nearly all of which were transferred as soon as possible from the medical to the surgical side, there was a history of tuberculosis in the father or mother in five cases; in one case two sisters died of tuberculosis; and in one an aunt. One case followed cancer of the pancreas, and one was in an old man with arterio-sclerosis; four cases followed pneumonia. Of the 14 cases which were operated upon, 12 left the hospital either perfectly well or very much improved. The only death was in the instance of empyæma secondary to cancer of the pancreas.

Unfortunately I have not full particulars of the bacteriological examinations made in all of the cases. The details of the early ones, taken by my late assistant, Dr. Meredith Reese, have been mislaid since his untimely death; so that, from our personal experience here, we can draw no conclusions as to the number of these cases in which the lesion really depended upon the presence of tubercle bacilli. I would again refer to the somewhat interesting circumstance that, with the exception of the pyopneumothorax cases, not a single instance of tuberculous purulent pleurisy was met with in the 101 autopsies in which pleurisy of one form or another was present.

(*c*) *Chronic adhesive tuberculous pleurisy.*

The special feature of chronic tuberculous pleurisy is the enormous thickening of the serous layers. In all the cases of chronic sero-fibrinous exudate the visceral and parietal layers were greatly thickened. Post-mortem, we see three varieties of this form.

(1) Primary proliferative tuberculous pleurisy. Any one of the three great serous membranes may be primarily affected in tuberculosis, though probably in the majority of all these instances the affection of the lymph sacs is secondary to that of the glands in connection with them, or the organs which they ensheathe. In this form the tubercles developing in the pleural and pericardial membranes cause early union of the surfaces, and there is never at any time a free exudate. With the progressive growth of the tubercles the layers become greatly thickened, and united may measure from 1 to 2 or more cm. in diameter. On section the thickened membranes seem to be made up of diffuse tuberculous tissue, sometimes caseous layers, and much fibroid tissue. In the early stages of the process grey and greyish yellow tubercle nodules are seen. With the exception of involvement of the bronchial glands, this may be the only

tuberculous process in the body. It may be unilateral or bilateral. I have seen but two instances in which it was strictly confined to the pleura, without any sero-fibrinous exudate. One was a young, vigorous Irish girl, who had recently come to the country, and was admitted to my wards at the University Hospital, Philadelphia, and died on the third day of an attack of malignant scarlet fever. The pleural layers on one side were enormously thickened, and in the condition just described. The other instance was a case of typhoid fever, which died under the care of my colleague, the late Dr. Ross, where the young man had bilateral chronic adhesive tuberculous pleurisy without any effusion. It is not infrequent to see this condition in part of the pleura, with pockets of a sero-fibrinous or curdy exudate at the sides or back, or on the diaphragmatic surface. Dr. Flexner showed at the Johns Hopkins Hospital Medical Society a remarkable case, to which I shall refer again in a few moments, in which both layers of the pleura, but particularly the costal, were enormously thickened, and miliary tubercles and larger cheesy masses were present. On the diaphragmatic surface alone there was an encapsulated sero-fibrinous exudate.

(2) Much more commonly, with very great thickening, and in the upper zone perhaps union, of the pleural membranes, there is separation of the layers below and on the diaphragmatic surface by an exudate usually sero-fibrinous, but sometimes containing curdy or even cheesy material. Thus of the 32 cases presenting post-mortem tuberculous pleurisy, there were 12 with very greatly thickened pleural membranes and sero-fibrinous exudate. Of these six were in connection with old pulmonary tuberculosis. As in Case I., referred to under the acute form, the onset may be abrupt as in acute pleurisy. The membranes gradually become greatly thickened. In that case there was an encapsulated serous effusion over the postero-lateral part of the left pleura, and in the rest of its extent the two layers

had united, and ranged in thickness from 1.5 to 2 cm. In connection with this variety there are two points of very great interest. In the first place it may be extremely difficult to recognize at sight that the process is tuberculous. In this very case of John A., who had been under our care and tapped repeatedly two and half months prior to his entrance to the hospital with an acute pnuemonia, it was only the closest examination of the dense, thickened pleural membranes which revealed old fibroid tubercles. A superficial, macroscopical examination might have entirely overlooked the tuberculous character of the process, as the lung on the left side presented no tubercles or caseous areas. Of course, it would have been in any case a suggestive fact that at the apex of the right lung there was an area of caseation and softening the size of a walnut, but I repeat again, as it is a point of importance, that without the most careful scrutiny the nature of the extensive, chronic pleurisy on the left side might have been overlooked. The second point of interest is the fact, well shown in the case just mentioned, and also in the case of John P., that a chronic tuberculous pleurisy may exist for a long time, and lead to great thickening without any extension of the fibroid process into the lung itself.

(3) And lastly, in some instances the fibroid processes in the pleura may invade the lung tissue, and lead to extensive sclerosis. In only one instance out of the 32 instances of tuberculous pleurisy was there any evidence of direct involvement of the lung.

Case XIII.—Chronic tuberculous pleurisy; interstitial pneumonia.

Wm. S., aged 60, admitted November 1st, 1890. The patient is a large, strongly built man; states that his family history is good; denies syphilis; has used alcohol to excess; had typoid fever five years ago; rheumatism six years ago.

He came in complaining of shortness of breath and cough, which symptoms he has had since the spring of the present year. He states also that he has lost very much in flesh. Has had no diarrhœa; no hæmoptysis, and does not think that he has had much fever.

Though a large framed man he is somewhat emaciated, and is anæmic. Pulse is 100; respiration 36. Chest is broad, of good depth; costal angle 90. There is deficient expansion on the left side; no definite dulness at the apices, or axillæ; at the left base the note is high-pitched. The breath sounds are enfeebled in front; expiration slightly prolonged; a few dry râles heard occasionally. There is a friction sound in the lower left axilla. At the left apex the breathing is puerile in type, with fine crackling râles. Many tubercle bacilli were found in the sputa. The case was regarded as one of senile tuberculosis, with some emphysema. He had repeated attacks of shortness of breath, and on the morning of the 9th he had a very severe attack, with small, rapid pulse, and died apparently in syncope. The temperature was very irregular, frequently sub-normal, as low as 96°, and on several occasions 95°.

Autopsy.—In right pleura cavity about 200 cc. of cloudy fluid. The pleura is divided into many compartments by fibrous septa. Both layers are thickened, and present many miliary tubercles and tuberculous granulation tissue. Left pleural cavity is obliterated by firm adhesions. The lungs are voluminous, and they do not retract on opening the chest. There are numerous, dense bands of fibrous tissue running through them, most marked at the apices, and these bands extend directly from the pleura into the lung substance, particularly from the root. There are small areas of caseous pneumonia. The bronchi of both lungs are somewhat dilated and filled with muco-purulent contents. There is a cavity the size of a hazelnut at the apex of the right lung. The condition is

that of an interstitial pneumonia, with dilated bronchi, and an extensive tuberculous pleurisy on the right side. There is a small tuberculous ulcer in the larynx.

3. *General serous membrane tuberculosis.*

There is a group of cases of tuberculosis in which the serous membranes are chiefly involved, either simultaneously or more commonly one after another, forming a clinical type fairly distinctive and readily recognized. There have been several interesting studies of this condition, notably the Paris Theses of Moran and Boulland in 1884 and 1885, and the careful study of Vierordt.* The pleuro-peritoneal membranes may be alone involved, or the pleuro-peritoneal and pericardial surfaces. There are, as noted by Boulland, three groups of cases. First, an acute tuberculosis, with rapid evolution of the disease in pleuræ and peritoneum, generally consecutive to local disease of the tubes in women, or of the mediastinal or bronchial lymph glands.

Second; cases in which the disease is more chronic in its nature, with exudation in both peritoneum and pleuræ, the formation of cheesy masses, and the occurrence of ulcerative and suppurative processes. In this group the pleural involvement is much more commonly secondary to the peritoneal, or both may be a sequence of pulmonary tuberculosis.

And, third, there are instances in which the pleuro-peritoneal affection is still more chronic, the tubercles hard and fibroid, both the membranes showing much thickening, often with very little exudation. My experience with this form of general involvement is not great, and of the 34 instances of peritoneal tuberculosis which have been under our observation at the Johns Hopkins Hospital, in only one was there involvement of the pleura.

I have not met with an instance in which the three serous

* Zeitschrift für Klinsche Medecin, Bk. XI.

surfaces were involved together, though many such are on record, and in some the disease has been almost exclusively confined to these membranes.

A knowledge of the existence of this combined infection is somewhat important, as such cases are often of great obscurity. More commonly the affection begins in the peritoneum and may be extremely chronic, and then gradually invades the pleura. In other instances there is a sub-acute pleurisy and subsequent invasion of the peritoneum. The cases often have a very protracted course; there are periods of great improvement, and there may be little or no fever. The following case is at present under observation:

Case XIV.—Pleuro-peritoneal tuberculosis; an illness with anasarca; great improvement; persistence of ascites; development of right-sided pleurisy; drainage of peritoneum.

R. A. B., colored, aged 30, farmer, admitted May 9th, 1893, complaining of swelling of the abdomen. Father and mother, two brothers and one sister living. Was healthy as a boy; measles at 19, scarlet fever at 27, no other serious illnesses. Married ten years, wife healthy, three children. Has not had veneral disease; has been a temperate man. For two years past patient has had failing of eye sight (cataract), which, he says, is due to irritating dust.

Present illness dates from last October, when he had an attack of gradually increasing shortness of breath, with swelling of the legs and body. Evidently this was a very severe illness, as he was confined to a chair for three months, and was not able to lie down. He had no special cough, but does not know whether he had much fever. The swelling in the legs gradually disappeared, and has been absent now for about three months. The swelling in the abdomen has persisted. He complains chiefly of shortness of breath on

exertion, and of the swollen abdomen. He has a little cough and slight, scanty expectoration. Patient is a medium-sized, moderately well built man; face not specially emaciated. The temperature on admission was 97.5°; rose in the evening to 103°. He lies quietly in bed, head not elevated, no respiratory distress. The conjunctivæ are a little yellow, pupils are dilated. Mucous membranes are somewhat pale. Pulse is regular, 90 to the minute, the vessel-wall a little sclerosed. The brachials pulsate visibly. The chest is well formed; costal angle good; the lower part of the thorax is expanded. On deep inspiration the left side moves more than the right. Percussion gives a dull note on the right side, beginning at the sixth rib in the recumbent posture, and in the erect posture at the fourth rib, the dulness being distinctly movable. Behind, when sitting up, the line of dulness is above the angle of the scapula. Percussion is clear throughout the left side. Tactile fremitus is diminished over the dull area on the right side, and the breath sounds are feeble. There is no friction murmur heard. Apex beat of the heart is not very distinct; pulsation in the fifth space, just inside the nipple line. The sounds are everywhere clear. A needle was inserted into the pleura and a serous, greenish yellow fluid was withdrawn, containing a little blood, which did not coagulate on standing. Cover slip preparations of the serum showed no organisms, and cultures on agar remained sterile.

The abdomen is distended and large, but symmetrical in the flanks and a little prominent in the umbilical and epigastric regions. On palpation it is everywhere soft, painless, not resistant, except in the upper zone, a little above the level of the navel. In the whole of this region up to the xiphoid cartilage and the costal margin, there is an ill-defined, doughy resistance, which terminates below in a tolerably well-defined border. On three separate occasions a very definite friction murmur was felt. The edge of the liver

is not palpable on deep inspiration, nor can the margin of the spleen be felt. On percussion there is tympany in the hypogastric and umbilical region, slight dulness in either flank, which is movable; no distinct fluctuation wave. There is a flat tympany in the epigastric and hypochondriac regions. The liver dulness begins at the border of the sixth rib, and extends to the costal margin in the nipple line. There are no glandular enlargements; no œdema of the feet. The urine is clear, a faint trace of albumin, a few leucocytes, and a few red blood corpuscles. The temperature during the first week of admission was irregular, ranging usually between 98° and 100°, but on three occasions rose to 103° in the evening. Frequently the morning temperature was very low. After May 16th his temperature did not go above 100°. He has gained in weight, and the small amount of sputum which has been obtained has always been negative.

A diagnosis of pleuro-peritoneal tuberculosis was made, and on the 10th Dr. J. T. M. Finney made an exploratory operation in order to drain the peritoneum. A quantity of dark, reddish-brown liquid was removed. The peritoneum was deeply injected, and the visceral layers studded with numerous grey and yellow-grey nodular tubercles. The omentum was rolled up, and there was great thickening about the stomach and colon.

It is not very uncommon to see the pleura and peritoneum involved secondarily in chronic disease of the lungs.

Case XV.—Pleuro-peritoneal tuberculosis in chronic pulmonary tuberculosis.—(Abstract).

D. W., aged 18, colored, admitted November 21st, 1889, complaining of cough, fever, and pain in the abdomen. About two months before admission he was wrecked and exposed in a boat for 24 hours. He dates his illness from

this time. He can give no details as to his family history. He had syphilis in the spring of 1889. The patient was a medium-sized, fairly well nourished young man, and at the first examination there were signs of disease at both apices, most marked at the right. There was high fever, and very rapid extension of the pulmonary disease, a large excavation developing within a few weeks at the top of the right lung. There were friction sounds heard in the axillary regions, and particularly marked on the left side. The abdomen was full and distended, sometimes painful, and he had diarrhœa. The patient did not improve in any way, but the fever persisted, and he became greatly emaciated, progresssively weaker, and died January 25th.

Autopsy.—Anterior mediastinal glands caseous. Both lungs were bound down by firm adhesions. The pleural membranes thickened; the costal layer, easily stripped off, was covered with fibrinous exudate, beneath which were numerous tubercles and caseous masses. On the pulmonary pleura there were numerous tubercles and flat caseous areas. Both lungs showed large cavities at the apices, numerous caseous areas, and miliary tubercles disseminated and in groups.

There was only a small amount of clear fluid in the peritoneum; the intestines were agglutinated, and on the peritoneal surface many groups of tubercles and flat caseous masses. The mesenteric glands were greatly enlarged and caseous. There were numerous tuberculous ulcers throughout the entire intestine, beginning just beyond the pylorus and extending to the rectum. There was tuberculous ulceration of the bladder.

We have many opportunites of seeing slight extension of the disease through the diaphragm, either downward from the pleura, or more often from the peritoneum into one or other pleura. In the following case there was extension rom the right pleura to the under surface of the diaphragm, and to the peritoneum covering the liver.

Case XVI.—Pulmonary tuberculosis; chronic tuberculous pleurisy; tuberculous peri-hepatitis; circumscribed tuberculous peritonitis.—(Abstract).

A. F., female, aged 19, admitted June 6th, 1892, complaining of shortness of breath. She had been in failing health ever since the birth of her child March 19th, 1892, when she had a severe cough, which has persisted ever since. She was pale, emaciated; respirations 44; pulse 148. There was deficient expansion at the right apex and signs of commencing cavity. She was in hospital during July and August, and signs of extensive pleurisy developed on the right side, for which she was aspirated and seven and a half litres of serous fluid removed. She had marked hectic fever. The pleural symptoms were complicated by the presence of a large abscess in Scarpa's triangle, which was opened and drained. She died September 12th of hæmoptysis.

Autopsy.—In the anterior mediastinum there were miliary tubercles and caseous masses; both pleural sacs obliterated. The parietal layer of the pericardium, adherent to the pleura, presented numerous fresh gelatinous looking tubercles. The lung and visceral pleura on the left side removed together. The layers were greatly thickened, and were covered with a hæmorrhagic, rough exudate 1 to 2 mm. in thickness. The right pleural sac also obliterated, and the membranes united by old adhesions; no acute pleurisy. Throughout the left lung there were several cavities; one at the apex, 3×3 cm., and in this there was a ruptured aneurismal dilatation of a branch of the pulmonary artery.

The under surface of the diaphragm on the right side was adherent strongly to the liver and covered with numerous grey tubercles, which were also present in numbers on the upper surface of the liver, and there were numerous hæmorrhages about them.

There was tuberculous disease of the lumbar vertebræ. The mesenteric glands were enlarged, but not caseous. There were tuberculous ulcers in the ileum.

Attention has often been called to the frequent association of tuberculous pericarditis with tuberculous pleurisy. Thus of 17 cases which I recently described* there was combined disease of these membranes in Cases IV., VII., and XV. In the following case the pericarditis in all probability followed the chronic tuberculous pleurisy.

Case XVII.—Chronic tuberculous pleurisy on the left side; acute tuberculous pericarditis and pleuritis dextra.

John P., aged thirty-eight years, admitted August 18th, with swelling of the legs and dyspnœa. The family history is good. He has been, as a rule, healthy, though in his childhood and youth he had many of the infectious diseases. He has been a moderate drinker. He denies syphilis. The present illness began about two weeks ago with pain in the left shoulder and about the heart. Feet began to swell ten days ago, and he has had cough and shortness of breath for about the same length of time. He has had no nausea; his appetite has been fairly good. Within the past few days he has become much worse.

On admission the patient had intense orthopnœa; pulse 130, but moderately full. He had a distressing cough, with clear watery expectoration. There was great œdema of the lower extremities and of the scrotum. The finger-tips and mucous membranes were bluish in color. In the examination of the heart at the time no murmur could be detected, but the second sound was accentuated at the pulmonary cartilage.

On the following morning the patient was quiet; respira-

* American Journal of the Medical Sciences, January, 1893.

tions 28 to the minute; pulse 84, the beats irregular both in rhythm and force, the volume fair, and tension not diminished.

Thorax apparently symmetrical, but the manubrium very prominent, expansion equal. In front, resonance on both sides good, though on the left side flatness begins at the fifth rib midway between the nipple and axillary line, and the dulness seems here to be somewhat movable. There are numerous sibilant and sonorous râles to be heard in front. Passing down the left side and into the axilla, the breath sounds become more feeble and fine moist râles are heard. Pitch of resonance at the extreme left base is higher than at the right, and the vocal resonance is somewhat diminished.

On auscultation there are numerous coarse and medium fine ràles to be heard at both bases. At the extreme left base the respiratory murmur is almost absent.

Heart: Point of maximum impulse difficult to localize; slight general heaving over the whole præcordial area; relative dulness begins above at second rib and extends well to the right of the sternum. The prominence above noted is just at the junction of the manubrium and gladiolus, and just at this point there is dulness over a very limited area. Relative dulness extends outward to a point nearly 5 cm. outside the nipple. The heart-sounds are heard with the greatest intensity at the fifth space a little inside of the nipple line. There the first sound is full and booming; the second not so loud. Passing inward toward the sternum the sounds become associated with a superficial, soft, squeaking sound, diastolic in time, heard loudest over the mid-sternum, and pericardial in character. This is heard faintly all over the base. The murmur is more distinct in forced expiration than during inspiration. The second pulmonic is a trifle louder than the second aortic sound. The radial pulses are equal in volume, and there is no pulsation in the upper sternal notch; there is no tracheal tugging. The exam-

ination of the abdominal organs is negative. The urine is yellow-colored, acid, sp. gr. 1024, distinct trace of albumin; several hyaline casts were found. Throughout the 20th and 21st the patient remained in much the same condition. On the 22d there was a slight rise in temperature to 100.5°; the pulse varied greatly in rate and character; at noon was slow, regular, and full, from 70 to 90 per minute, and again was as rapid as 140. The patient, in many respects, was better. The œdema of the legs had disappeared. The urine had increased in quantity. On the 19th only 180 c.c., and on the 20th 350 c.c. had been passed. On the 21st and 22d the amounts were 700 and 1100 c.c.

23d. The temperature has been between 97° and 98°; at the morning visit the pulse was 148, regular in force and rhythm; the respirations 32. The patient was lying quietly on left side. The physical signs practically those noted above, with the exception that there is an extension of the œdema at the base of the lung. The patient died suddenly at 4.30 P. M. to-day.

Autopsy (by Dr. Flexner).—Large, muscular man; moderate œdema of the legs and of the subcutaneous tissue of the trunk. Fat well retained, both beneath the skin and in omentum and mesentery.

Pericardium is adherent to the left pleura; the sac thickened and contains a considerable amount of clear serum. Both layers are covered with a thick fibrous deposit, looking like a hairy coat. The thickness of the pericardium over the heart is 3 mm. When incised the thickened layer is grayish in color, with many opaque or yellowish points scattered here and there, often continuous, and having the well-recognized characteristics of tubercles of this membrane. The heart was greatly enlarged. The valves were normal. The thickness of the left ventricle was 17 mm.; length of ventricle, 8.5 cm.; mitral orifice, 10.5 cm. in cir-

cumference. Thickness of right ventricle 6 mm. Tricuspid orifice 12 cm. in circumference. The walls of the auricular appendix are almost completely converted into a grayish-white material with only a thin internal film which appears like muscle. In the endocardium of the left ventricle are numerous ecchymoses. There are also a few small ones on the right ventricle and in the auricles, and on the endocardium of the auricles are a few small, round, whitish miliary tubercles.

The left pleura is much thickened; parietal and costal layers adherent in places, but where not in actual contact there is clear serum between them. The costal pleura strips up with difficulty, and is very hard and cuts like cartilage. The diaphragmatic pleura is especially thickened, and on section it is seen to be composed of a dense, almost cartilaginous, grayish tissue, containing yellow, opaque, caseous masses. The apex of the left lung is retracted, hard to the touch, and on section contains a dense, deeply pigmented connective tissue, and old areas of caseation; no calcification. There are a few small foci of miliary tubercles, and scattered fibrous tubercles elsewhere in the lung.

The right lung is voluminous, and in the greater part of its extent free from adhesions, but the pleural surfaces present numerous grayish-white elevated masses, single and conglomerate, which can be scraped off with difficulty. The costal pleura present similar tubercles. About these there are, here and there, fresh fibrin. In the apex the upper lobe presents a few foci of fibrous miliary tubercles.

The spleen contains a few scattered tubercles. Nothing of note in the abdominal viscera; the intestines did not present tubercles.

III. General Pathology.

The pathology of serous membrane tuberculosis turns on the avenues of infection rather than upon any special pecu-

liarity in the lesions. Miliary tubercles, with inflammatory exudate, serous or hæmorrhagic; acute, rapidly caseating and ulcerative processes with necrosis and suppuration; a chronic fibro-tubercle, nodular and diffuse, are here met with as in the lungs and elsewhere,—and the chief interest relates to the

Avenues of Infection.

(1) Doubtless a great majority of all cases of tuberculous pleurisy arise from direct infection from the lung, a tuberculous focus invading the membrane, as may be seen any day in the autopsy room. Rapid development of a fibrinous exudate at the spot controls the extension, blocking the lines of transmission and limiting the process. Though directly excited by contiguity, the pleurisy is not always associated with an eruption of miliary granules, but may be simple. There would appear sometimes to be an antagonism between the pleural and pulmonary disease, and it will have been noted in several of the post-mortems of the cases previously given that very extensive affection of the pleura occurs with very slight or even without any disease of the lung on the side involved. The possibility of infection of the pleura by contact from tuberculosis of the mediastinum, tuberculous abscess of this part, and indeed from cold abscess of the thoracic wall, must also be considered.

(2) Infection through the lymphatics. It was one of the great generalizations of Bichat when he spoke of the serous membranes as "grands reservoirs," a truth demonstrated by the intimate connection known to exist between these surfaces and the subjacent lymph vessels. The beautiful investigations of Klein, Arnold, and others have taught us the complicated anatomy of the lymph apparatus of the lungs and pleura, and also the course of the lymph streams, so that it is not difficult to understand how the

serous membrane may be affected. We all inhale tubercle bacilli, perhaps not daily, but dwellers in cities and workers in hospital wards certainly inhale them very frequently, attached to the dust particles, the fate of which in the respiratory system is well known. A certain proportion in the trachea and bronchi are dealt with by the leucocytes, and are brushed by the cilia to the larynx; the sweepings of the night appear in the dark morning expectoration. Many of the particles reach the alveoli, and are here also in part attacked by the large desquamating cells of the alveolar epithelium, an important function of which is, no doubt, to help in the general scavenger work which goes on incessantly in the lungs. But a considerable number escape the phagocytes of the bronchial tree and of the alveoli, and pass through the openings in the latter into the alveolar stroma. Those from the central air-cells enter the deeper lymph channels which surround the bronchi, and in their course pass through many of the lymph nodes, at every one of which they are attacked, and many of the particles remain fixed in the cells of the follicular cords or permanently imbedded in the stroma. Those particles which reach the more superficial alveoli pass into the wide sub-pleural lymph streams. Here, too, at the periphery of the lobules, as may be seen in the lung of any adult, many of the dust particles are picked out and fixed in the peri-lobular tissue, so that often the lobules are accurately mapped out by a line of black particles. Ultimately, a certain number reach the bronchial glands, which become gradually in all of us, as the years pass, more and more deeply pigmented. The tubercle bacilli attached to the dust particles follow these routes, and their fate depends very much upon the local conditions, which, happily for the majority of us, are not favorable to their growth. It is interesting to note, however, with reference to the mode of infection in tuberculosis, the large proportion of individuals in whose *dust filters*, as the lymph

nodes of the respiratory system may be called, tubercle bacilli effect a lodgement. Indeed there have been important observations within the past few years to show that the bacilli may be present (without having caused any mischief) in apparently healthy lymph glands. There is direct communication between the sub-pleural lymphatics and the sac of the pleura, so that it is possible to conceive of a direct entrance of the bacilli in that way. More commonly, however, the disease spreads from a sub-pleural nodule or a lymph node in which the bacilli have grown. The wide and free anastamoses which have been demonstrated to exist in the lymph vessels of the pulmonary pleura favor the rapid diffusion of the virus under suitable conditions. Possibly, too, in some instances, direct infection may take place from the bronchial and tracheal lymph glands. Under all these circumstances it is the visceral layer of the pleura which is involved. The lymphatics of the parietal pleura have wide and extensive communications, discharging as they do partly into the lymph glands along the vertebræ, and partly in the anterior mediastinal group, along the internal mammary artery. Infection may come from the lymphatic glands in the neck, particularly the supra-clavicular, which communicate freely with those of the axilla and of the sub-maxilla. Infection of the pleura in tuberculosis of the glands in these two groups has been frequently noted, and has been made the subject of a special essay by Hernandez.

In rare instances the disease may extend to the pleura from tuberculous caries of the bones in the neighborhood. An interesting instance of this was reported to the Johns Hopkins Hospital Medical Society by Dr. Flexner last winter. A colored man, aged 24, had a sinus in the neck which led to an erosion, involving the outer third of the right clavicle. The supra-clavicular glands in the neighborhood were involved, particularly the group between the clavicle and the upper border of the pleura, which were

enlarged and caseous. The right costal pleura was greatly thickened, firmly united to the visceral layer, except on the diaphragmatic surface on which there was a cavity the size of an orange filled with a sero-fibrinous exudate.

And lastly, the pleura may be infected through the wide communications which exist between the lympathics of the peritoneum and those of the diaphragmatic pleura, and the lymphatics of the mediastinum.

IV. Diagnosis.

A disease presenting clinical variations so extreme as those which I have attempted to portray must necessarily offer at times serious difficulties in its detection. At the outset it may be frankly acknowledged that often in cases of acute sero-fibrinous pleurisy, coming on with chills and fever and gradual effusion, we have not the data upon which to base a diagnosis. Neither the appearance of the individual, the family history, the onset, the course, or the character of the exudate may be in any way suggestive. On the one hand, there can be no question that many instances, as in Case I., so often referred to, occur in robust individuals of previous good health, with all the characters of pleurisy *a frigore*; and yet the subsequent history may point very clearly to the fact that the process has been from the outset tuberculous. On the other hand, the view which has of late found so much favor, that a large proportion of all acute pleurisies are tuberculous, is certainly unfounded, as shown by the post-mortem notes already referred to, in which non-tuberculous pleurisy of one form or another was present in two-thirds of an unselected series of cases from medical wards. I have already called attention to the points to be specially investigated; the antecedents, family and personal, the careful inspection of the groups of lymph glands contiguous to the pleura, the repeated examination of the expectoration, which may contain tubercle bacilli from even

a very small focus of softening tubercle in communication with the bronchus. On more than one occasion it has happened that their discovery after repeated examination has cleared up the nature of an obscure pleurisy; and it is worth noting that in Case I. the only spot of softening from which the tubercle bacilli could have come in any numbers did not exceed the size of a hazelnut, and was in the lung on the side opposite to that of the effusion. The physical characters of the exudate offer in a majority of instances nothing distinctive. A hæmorrhagic exudation is suggestive but by no means distinctive, in as much as it may occur in cancer, or it may occur with ordinary simple pleurisy, as in two instances in our list. It is important to note that the effusion may be hæmorrhagic in either a chronic or in an acute form. I call to mind one instance in which the presence of hæmorrhagic exudate led us to suspect a terminal tuberculous pleurisy, but there were no tubercles on the membranes.

The bacteriological examination has been made now so frequently in acute pleurisies that there are facts enough at our disposal to warrant a somewhat definite opinion, and the general conclusion is that, except in very rare instances, the serous exudates are sterile, and tubercle bacilli have only been detected in a very moderate number, in only 32 cases, according to the recent article of Prince Ludwig Ferdinand of Bavaria. The inoculation of the exudate into the peritoneum of the guinea-pig, which has been practised in many cases, also gives variable results, but when positive is of great value.

The inoculation with tuberculin is, as mentioned, uncertain, and I may state here an instance in which it led us into error. Just as we were beginning to try it the late Dr. Christopher Johnston sent into the wards a young woman aged about 28 or 29 with a bunch of enlarged lymph glands on the left side of the neck and the axilla.

She was fairly well nourished and made no other complaint but of gradual and progressive enlargement of these groups during several months. Within ten days or two weeks after admission a pleurisy developed on the same side, which we very naturally thought to be tuberculous. She was treated with injections, and the reaction on each occasion was particularly active. No benefit, however, followed them, and some weeks later she went to her home, where she shortly afterwards died. The autopsy, performed by Dr. Councilman, showed cancerous lymph glands in the sub-clavicular and axillary regions and extensive cancerous pleurisy—the primary disease being a nodule of carcinoma about the size of a walnut in the left breast. Some months subsequently, in illustration of the curious coincidences which we all meet in practice, I saw a case presenting striking similarities in the practice of Dr. Burns of Toronto; also in a comparatively young woman, but the infiltration about the pectoral muscle called my attention to the condition of the breast.

The diagnosis of the purulent form of tuberculous pleurisy is less difficult. A proportion of these, at least 75 per cent., depend upon infection with streptococci, the pneumococci, or the staphylococci. The tubercle bacillus may be present and in some acute cases, as in the one referred to, very abundant in the pus. In other instances, definitely proved to be tuberculous, staphylococci have been present, and sometimes the effusion is sterile. The course may be extremely suggestive, and it has long been known that the latent variety of empyæma is not uncommonly tuberculous. As already mentioned, the fluid may not be truly purulent, but the turbidity due to the presence of large quantities of fatty material.

And lastly, a great difficulty in diagnosis may exist in these cases of sero-fibrinous pleurisy which recover with thickening of the membranes and persistence of flatness at the base. The most suspicious instances are those in which

the fluid contsantly recurs in spite of repeated tappings, and in which, with diminution apparently in the amount of exudate, the flatness persists, usually with transmission of the tactile fremitus, and sometimes, as time proceeds, marked flattening of the affected side. The records of Cases I., IX., X., and XI. show a sequence of events only too common. Possibly some of these cases, with flattening at the base and slight retraction, heal, and no further trouble occurs. Certainly they are not always tuberculous, such a process may follow a simple sero-fibrinous pleurisy or an empyæma. Thus in a young woman aged 23, who was admitted to my wards November 17th, 1890, with the right chest flattened behind and at the sides, with dulness at the right base and curvature of the spine (and who died of anæmia associated with syphilis of the liver, and lymphatic nodules), the right lung was firmly adherent, the pleural membranes were thickened, particularly at the extreme base, and between the thickened layers there was a cavity containing about 70 cc. of an opaque, whitish fluid. The cavity presented adherent calcareous flakes, and there was no caseation. Such instances are by no means uncommon in post-mortem work, and unquestionably contraction and flattening at the base and slight drooping of the shoulder may persist for an indefinite number of years without leading to any more damage than perhaps a progressive bronchiectasis in the lower lobe. Clinically, too, these cases are not very infrequent, and though one may have a suspicion from the history, yet good health may be maintained for many years and evidence may be entirely wanting of any tuberculous process.

V. Treatment.

The indications are two-fold; first to limit and control the exudate and to promote its absorption. It would take me far away from the immediate subject to discuss here in

full the therapeutics of pleural effusion. In the early stage it is sufficient to allay the pain, if severe, with opium, to reduce the fever, if high, by sponging, and to keep the bowels freely opened. It is doubtful whether the salicylates deserve the confidence which many claim. To promote absorption various measures are advised. It is important to remember that when fluid remains in the chest it is for the very good reason that it cannot get out, owing to blocking of the lymph paths. Absorption from the pleura goes on, as has been shown experimentally, with extraordinary rapidity, chiefly, if not entirely, from the costal layer. Probably in all instances of pleurisy with effusion, do what we may, the absorption has to await the freeing of the obstructed lymph channels. I still believe that good results are seen by putting the patient on a dry diet and giving brisk, saline cathartics. It is a rational practice, and in some instances I have seen the exudate diminish rapidly. The diuretin, when it acts, is useful in the same way. If at the end of ten days the exudate persists, and is at the level of the fourth rib in the erect posture, aspiration is advisable, and it may be repeated again in a few days if the fluid reaccumulates. So far as I know, there are no greater risks in the tuberculous than in the simple sero-fibrinous cases, and it is very important to relieve the lung early of the compression to which it is subjected by any large quantity of fluid. I think, however, the risk of the compressed lung becoming the seat of tuberculosis is not very great; more serious is the danger lest it should become bound down by such firm adhesions that it cannot expand. Gentle counter-irritation of the skin is probably beneficial in these later stages, stimulating the lymphatics of the costal pleura.*

* The relation between the sub-cutaneous and pleural lymphatics must be very close. A fluid containing colored particles in suspension, injected beneath the skin in the axillary region of a rabbit, finds its way to the costal lymphatics, and the anterior mediastinal glands become stained. (*Canada Medical & Surgical Journal*, 1875. Article on Anthracosis.)

In the cases of chronic sero-fibrinous effusion with thickening of the membranes the fluid re-accumulates rapidly, and aspiration may have to be performed very many times. In these instances systematic pulmonary gymnastics should be practised. The expansive efforts of forcing water from one large Wolff's bottle to another is a good method. When the exudate is purulent the case should be transferred to the surgeon for thorough drainage.

The second indication is to improve in every way possible the general nutrition of the patient, so as to favor conditions promoting the healing of the tuberculous process. No doubt, as in pulmonary and peritoneal infection, many instances of tuberculosis of the pleura recover and leave no more damage than that associated with slight thickening of the membrane. A life in the open air, regular habits and exercise, a nutrious diet, and the use of the remedies which promote in every way digestion and the assimilation of food should be advised. And finally we may lay to heart the words of Sir Andrew Clark: "When we have a patient with basic fibrinous pleurisy, let us hold him fast, restrict his freedom and treat him carefully until every remnant of it is gone."

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